

GRAM FORMULA MASS

Name _____

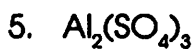
determine the gram formula mass (the mass of one mole) of each compound below.

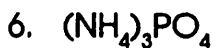






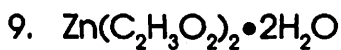




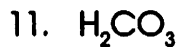


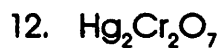




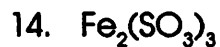














THE MOLE AND AVOGADRO'S NUMBER

Name _____

One mole of a substance contains Avogadro's Number (6.02×10^{23}) of molecules.

How many molecules are in the quantities below?

1. 2.0 moles

2. 1.5 moles

3. 0.75 mole

4. 15 moles

5. 0.35 mole

How many moles are in the number of molecules below?

1. 6.02×10^{23}

2. 1.204×10^{24}

3. 1.5×10^{20}

4. 3.4×10^{26}

5. 7.5×10^{19}

MOLES AND MASS

Name _____

Determine the number of moles in each of the quantities below.

1. 25 g of NaCl

2. 125 g of H_2SO_4

3. 100. g of KMnO_4

4. 74 g of KCl

5. 35 g of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

Determine the number of grams in each of the quantities below.

1. 2.5 moles of NaCl

2. 0.50 moles of H_2SO_4

3. 1.70 moles of KMnO_4

4. 0.25 moles of KCl

5. 3.2 moles of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$



Unit 2

C.3 SUPPLEMENT: MOLAR MASS COMPUTATION AND CONVERSIONS


Molar Mass Computations

The **molar mass** of a substance is the mass of one mole (6.02×10^{23} units) of any substance. For the purpose of this course, we will use the nearest whole-number value of the atomic masses found on the Periodic Table.

To find the molar mass of a substance, multiply the number of atoms of each element by the atomic mass of the element. Then add the masses of the various elements.

Example 1: What is the molar mass of iron(III) oxide, Fe_2O_3 ?

$$\begin{array}{r} 2 \text{ Fe} = 2 \times 56 = 112 \\ 3 \text{ O} = 3 \times 16 = 48 \\ \hline \text{FeO}_3 \qquad \qquad 160 \text{ g/mol} \end{array}$$



Example 2: What is the molar mass of magnesium hydroxide, $\text{Mg}(\text{OH})_2$?

$$\begin{array}{r} 1 \text{ Mg} = 1 \times 24 = 24 \\ 2 \text{ O} = 2 \times 16 = 32 \\ 2 \text{ H} = 2 \times 1 = 2 \\ \hline \text{Mg}(\text{OH})_2 \qquad = 58 \text{ g/mol} \end{array}$$

Determine the molar mass of each substance.

1. Nitrogen gas: N_2
2. Sodium chloride (table salt): NaCl
3. Sucrose (table sugar): $\text{C}_{12}\text{H}_{22}\text{O}_{11}$
4. Chalcopyrite: CuFeS_2
5. Malachite: $\text{Cu}_2\text{CO}_3(\text{OH})_2$

Mole-Mass Conversions

Once the molar mass of a substance is known, it is fairly easy to calculate moles from grams or grams from moles.

Example 3: How many moles are present in 352 g of iron(III) oxide, Fe_2O_3 ? This can be expressed in two ways. It is either

- 160 g of Fe_2O_3 contains 1 mole (160 g/1 mol) or
- 1 mole of Fe_2O_3 contains 160 g (1 mol/160 g)

Either fraction may be used as a conversion factor so that the units of a calculation will cancel.

Step 1: Calculate the molar mass of iron(III) oxide. From Example 1, it is 1 mol = 160 g.

Step 2: Arrange the molar mass so the original units cancel and the desired units are on top.

$$352 \text{ g} \times \frac{1 \text{ mol}}{160 \text{ g}} = 2.2 \text{ mol of } \text{Fe}_2\text{O}_3$$

Example 4: How many grams are present in 1.43 moles of magnesium hydroxide, $\text{Mg}(\text{OH})_2$?

Step 1: Calculate the molar mass of magnesium hydroxide. From Example 2, it is 1 mol = 58 g.

Step 2: Arrange the molar mass so the original units cancel and the desired units are on top.

$$1.43 \text{ mol} \times \frac{58 \text{ g}}{1 \text{ mol}} = 83 \text{ g of } \text{Mg}(\text{OH})_2$$

Calculate the following. (Hint: The molar masses are from Questions 1–6.)

- 1.0 mol of Azurite, $\text{Cu}_3(\text{CO}_3)_2(\text{OH})_2$, is how many grams?
- 6.3 mol of N_2 is how many grams?
- 84.6 g of NaCl is how many moles?
- 564 g of $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ is how many moles?
- 3.95 mol of CuFeS_2 is how many grams?
- 0.985 g of $\text{Cu}_2\text{CO}_3(\text{OH})_2$ is how many moles?
- 36.5 mol of $\text{Cu}_3(\text{CO}_3)_2(\text{OH})_2$ is how many grams?

Unit 2

C.4 SUPPLEMENT: PERCENT COMPOSITION OF MATERIALS AND CONSERVATION OF MASS

Example: What percent of iron(III) hydroxide, $\text{Fe}(\text{OH})_3$, is oxygen?

Step 1: Find the molar mass of the compound.

$$\begin{array}{rcl} 1 \text{ Fe} & = & 56 \text{ g} \\ 3 \text{ O} & = 3 \times 16 & = 48 \text{ g} \\ 3 \text{ H} & = 3 \times 1 & = 3 \text{ g} \\ \hline & & = 107 \text{ g/mol} \end{array}$$

Step 2: Find the percentage by dividing the part by the whole and multiplying by 100.

$$\frac{48 \text{ g oxygen}}{107 \text{ g total}} \times 100 = 45\%$$

1. What percent of magnesium bromide, MgBr_2 , is magnesium?
2. What percent of glucose, $\text{C}_6\text{H}_{12}\text{O}_6$, is carbon?
3. What percent is zinc of $\text{Zn}_3(\text{PO}_4)_2$?
4. What percent of AgNO_3 is silver?
5. Which has the higher percent of aluminum, Al_2O_3 or $\text{Al}(\text{NO}_3)_3$?

Find the mass of 0.89 mol of CaCl_2 .

Determine the number of atoms that are in 0.58 mol of Se.

A bottle of PbSO_4 contains 158.1 g of the compound. How many moles of PbSO_4 are in the bottle?

How many moles of barium nitrate (BaNO_3) contain 6.80×10^{24} formula units?

Find the mass of 1.112 mol of HF.

Determine the number of atoms that are in 1.25 mol of O_2 .

Determine the number of moles of C_5H_{12} that are in 362.8 g of the compound.

How many moles of magnesium bromide (MgBr_2) contain 5.38×10^{24} formula units?

How many formula units are in 1.4 g of PbCl_2 ?

If you burned 6.10×10^{24} molecules of ethane (C_2H_6), what mass of ethane did you burn?

Determine the mass of 2.94×10^{24} molecules of decane ($\text{C}_{10}\text{H}_{22}$).

How many formula units are in 5.1 g of TiO_2 ?

How many formula units are in 5.6 g of H_2S ?

What is the mass of 3.62×10^{24} molecules of methanol (CH_3OH)?

A bottle of KMnO_4 contains 66.38 g of the compound. How many moles of KMnO_4 does it contain?

How many formula units are in 3.5 g of NaOH?

PERCENTAGE COMPOSITION

Name _____

Determine the percentage composition of each of the compounds below.



K = _____

Mn = _____

O = _____



H = _____

Cl = _____



Mg = _____

N = _____

O = _____

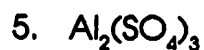


N = _____

H = _____

P = _____

O = _____



Al = _____

S = _____

O = _____

Solve the following problems.

6. How many grams of oxygen can be produced from the decomposition of 100. g of KClO_3 ? _____

7. How much iron can be recovered from 25.0 g of Fe_2O_3 ? _____

8. How much silver can be produced from 125 g of Ag_2S ? _____